Emergency Watershed Protection Assessment
Simi and Verdale Incidents
November 10, 2003

View looking west/southwest down into Sulphur Canyon. High Severity Burn-Drains into Las Llajas Canyon

Assessment Team

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Simi & Verdale Incidents

Emergency Watershed Protection Assessment

Summary

The Simi and Verdale Incidents were evaluated by the California Department of Forestry and Fire Protection (CDF) to determine whether Emergency Watershed Protection (EWP) efforts are necessary. CDF, in cooperation with local, state and federal agencies and interested parties, conducted aerial and field surveys looking primarily at critical watersheds within the burned areas. Personnel concentrated their efforts on an evaluation of burn severity with the goal of determining the accuracy of the burn severity map produced from aerial imagery. An additional focus of the assessment was an analysis of soil erosion potential that included testing for hydrophobic (water repellent) soils.

Following the surveys, the CDF team produced this assessment that identifies critical concerns and recommends mitigation measures. The assessment determined that, in general, the burn severity map was accurate and that hydrophobic soils are common in the burned area. Furthermore, soil erosion and storm water runoff are expected to increase significantly as a consequence of the fires. The areas of greatest concern are the Pico, Las Llajas, Happy and Chivo watersheds which burned with highest severity and have significant resources at risk below the burned areas. In general, however, the vast majority of the burned area is not recommended for treatment. Upgrading the early storm detection and warning system and monitoring the burned area and storm runoff are the primary recommended actions.

Introduction

The Verdale Incident (CALAC-3220027) started at 1:07p.m. on October 24, 2003 and burned a total of 8,488 acres (all of which were in FRA). The Simi Incident (CAVNC-80298) started at 2:50p.m. on October 25, 2003 and burned a total of 107,599 acres (96,050 acres SRA; 10,673 acres LRA and 876 acres FRA). The Verdale Incident was roughly divided 60/40 in Ventura and Los Angeles Counties, California. The Simi Incident was primarily in Ventura County with a portion of its eastern flank in Los Angeles County. Following containment of these fires, a team from the California Department of Forestry and Fire Protection conducted an assessment of the burned areas to determine if Emergency Watershed Protection (EWP) measures were required. The Director of CDF may authorize EWP work when the potential for soil loss and floods from areas denuded by fire pose a significant threat to watershed values or public health, safety or welfare.

The primary goals of this emergency watershed protection assessment were to:

1. Estimate the percent of area burned within each priority watersheds.

2. Estimate the burn severity and ground check the burn severity map.

3. Evaluate the soil erosion potential with a focus on soil hydrophobicity.

4. Evaluate the condition of roads and human-caused disturbance within each watershed that may contribute to flood events.

5. Identify specific problem areas in need of repair.

6. Develop recommendations to mitigate potential soil erosion and the impacts flooding.

Fire History

The western half of the Simi Incident burned in the 1980s. The eastern half burned in the 1970s. This time frame has allowed the chaparral plant communities to increase the fuel load in the eastern fire area. It was the eastern half of the fire where the majority of the high burn severity occurred. The western half was mostly low to moderate in burn severity. Additionally, the Verdale Incident area burned in the late 1980s. In this case the burn area was dominated by a low burn severity.

The following is a description of the assessment process and a summary of findings and recommendations.

Methodology

The Emergency Watershed Protection Assessment began with gathering information from a wide variety of sources. Important sources of information were as follow.

- The Ventura County Fire Department (VCFD) provided detailed maps of the burned areas including information on fire history. In addition, VCFD provided significant logistical support.
- The Ventura County Watershed Protection District provided detailed maps of the watersheds within the burned area and GIS support. Their knowledge of the watersheds allowed the fieldwork to concentrate on the most sensitive watersheds.
- Local individuals and interest groups provided information on site conditions.
- The United States Forest Service (USFS) and NASA provided a variety of aerial images of the burned areas.

The primary focus of the watershed assessment was an evaluation of the burn severity map, which classified the burn area into four severity categories (unburned to very low; low; moderate and high). This map utilized high elevation aerial imagery produced by NASA AMES. The USFS acquired and processed the imagery and developed a Burned Area Reflectance Classification (BARC) map. The USFS then posted the information on a website (*ftp://ftp2.fs.fed.us/incoming/rsac/baer/So_Calif/MASTER)* for ftp download. Scott Holder, hydrologist with the Ventura County Watershed Protection District, down loaded the image and overlaid it with existing watershed maps. At the time of the flight, the far eastern portion of the fire was not visible due to cloud cover. Capturing additional satellite or aerial imagery is planned.

The fieldwork began with a helicopter flight provided by the Ventura County Sheriff's Department. The flight went by the Verdale Incident and circled the Simi Incident concentrating on the five watersheds identified as high priority because of significant resources at risk. The five watersheds were Happy Canyon, Tapo Canyon, White Oak-Hummingbird, Devil and Pico. From the air, ocular estimates of the area burned and burns severity were made. Also evaluated were resources at risk especially below each watershed and the characteristics of the watershed outflows and their ability to handle flood flows.

Following the helicopter flight, the CDF team drove into the watersheds in three teams of two for three days. After the initial five watersheds were assessed, additional areas were evaluated. These areas included the Chivo, North Simi Dry and Las Llajas watersheds, the north side of the Simi Incident and the Verdale Incident. At the conclusion of the fieldwork each day, the CDF team reassembled for a debriefing. Field notes, photographs and GPS points were collected and organized, and a summary of findings by watershed was developed. Each watershed assessment included an analysis of the percent of the watershed burned, burn severity, soil conditions and roads. Site-specific potential concerns and recommendations were developed along with concerns and recommendations that applied to the entire burned area. These items are described below.


Tapo Canyon—Light Burn Severity

Percent Burned

Percent burned refers to that portion of the total watershed that burned. In some cases the watershed boundaries were outside of the fire perimeter. Often, most of the unburned areas inside the fire perimeter were either unvegetated, mining operations, golf courses or roaded areas.

Burn Severity

Burn severity relates specifically to effects of the fire on soil conditions and hydrologic function (e.g., amount of surface litter and duff, erodibility, soil structure, infiltration rate and runoff response). Although burn severity is primarily a reflection of fire effects on vegetation, vegetative condition and pre-fire vegetation density are among indicators used to assess burn severity. However, there may be complete consumption of vegetation by fire, with little effect on soil and watershed function. And conversely, there can be low and/or moderate burn severity that results in hydrophobic soils (more on hydrophobic soils below). Both of these situations were found to be true in many locations on these incidents and thus burn severity does not appear to be a good indicator of hydrophobicity.

The determination of burn severity for this assessment was largely based on pre-fire vegetation types and a visual inspection of the post-fire condition of the remaining fuels. The unburned classification included areas where only the duff layer was partially burned. Burned areas vegetated with grass were usually considered as low burn severity.

Burned areas vegetated with brush or chaparral fell into all four classifications. However, this vegetation type usually appeared to have burned with moderate to high severity. The difference between moderate and high burn severity was based on the condition of the remaining brush/chaparral. Areas of chaparral that were burned to the point where long stems remained were considered moderate burn severity. Areas of chaparral that were burned to the point where short to no stems remained, were considered high burn severity. The presence of white ash was also considered an indicator of a high burn severity.

Areas vegetated by trees was also had a mixture of all four burn severities. Low burn severities were associated with only a ground fire with no extension into the tree canopies. Moderate burn severity were associated with fire extension into the tree canopy of a small number of individual trees. Finally, high burn intensities were determined with the complete consumption of the tree canopies of the majority of trees within an area.

The burn severity estimates found in the following watershed assessments were based on observations from the helicopter flight and subsequent ground checking. These ocular estimates are intended to supplement and support the BARC map analysis and not take its place.

Soil Conditions

An additional primary concentration of this assessment was an evaluation of soil conditions for erosion potential. Soil testing to determine the extent and severity of hydrophobic soils was the main method used to determine erosion potential. A visual assessment of soil erosion potential was also conducted.

Soils that repel water are considered hydrophobic. A thin layer of soil at or below the mineral soil surface can become hydrophobic after intense heating. The hydrophobic layer is the result of a waxy substance that is derived from plant material burned during a hot fire. The waxy substance penetrates into the soil as a gas and solidifies after it cools, forming a waxy coating around soil particles. The layer appears similar to non-hydrophobic layers. Coarse textured soils, such as sandy soils, are more likely to become hydrophobic because the hot gases can more easily penetrate through the soil.

Hydrophobic soils are important because they reduce the amount of water infiltration and thus increase the amount of runoff. Increased runoff causes increased erosion and higher storm flows. The hydrophobic layer is generally one half to three inches beneath the soil surface and is commonly as much as one inch thick. Another potential problem resulting from hydrophobic soils occurs when a strong water repellent layer is

found one to two inches beneath the soil surface. In this situation, a slip plane is created and mass wasting of the top one to two inches of soil can occur over large areas.

Soil test sites were randomly selected in the watersheds surveyed with an emphasis on areas that appeared more severely burned because that is where hydrophobic soils were expected to be concentrated. Unburned areas were also tested as a control. The testing method used involved scraping away the ash layer to expose mineral soil. Several drops of water were placed on the soil surface and the rate of absorption was timed. In the immediate area, soil was scraped away to create additional small flat sites that were one, two and four inches in depth. The process was repeated to determine the depth and severity of the water repellent layer. Soils where water absorption occurred after 30 to 60 seconds were considered moderately hydrophobic. Soils with water absorption after 60 seconds or more was consider severely hydrophobic.

Cracked Soils in Pico Canyon

Road Conditions

Seasonal roads can contribute significant amounts of sediment into watercourses if constructed poorly or not maintained. The amount and condition of the roads within the

watershed were a consideration when developing recommendations. Disturbed areas such as mining operations and other developments were also considered in the evaluation of sediment input sources within a watershed.

Concerns

Site-specific concerns and general concerns for the entire burned area were identified. An example of a site-specific concern is a watercourse loaded with woody debris in one watershed that could block a downstream culvert. A general concern is the amount of hydrophobic soil identified in the entire burned area.

Recommendations

The team provided recommendations to address problems caused by the incident and significant pre-existing concerns. Where the use of CDF resources (e.g., hand crews) are proposed, an estimate of the time commitment is given. For other recommendations not involving CDF resources, no time estimate is given.

General Findings

In general, it appears that the analysis of burn severity found on the BARC map entitled "Simi and Piru Fires Burn Severity Map – November 2003" is a good representation of conditions found on the ground. However, the fire burned with significantly greater severity than mapped in the Chivo, Las Llajas, Happy Canyon and Pico watersheds. These findings are described in the individual watershed assessments below. One possible reason for the discrepancy in findings may be the rainfall that occurred just before the imagery was acquired on November 1, 2003. This rain (approximately one-quarter to one inch) potentially could have washed away some of the white ash especially on the steeper slopes. This possible removal of ash was observed in the field. Some high severity areas on steep slopes had little white ash remaining. The sites that still had white ash tended to be on low and moderate slopes.

Hydrophobic soils were found to be common throughout the Simi Incident. Almost all of the dozens of soil tests completed showed a severe level of hydrophobicity.

Other observations included extensive digging or burrowing by gophers and/or ground squirrels throughout the burned areas especially in grasslands and areas with oak trees. The large number of soil mounds and burrows will increase water infiltration. Clay soils exhibited heavy cracking. Soils in steeper areas were shallow and rocky with preexisting sliding and raveling into the drainages. In general, no heavy concentrations of stored sediment were observed within the drainage channels indicating either only moderate past erosion and/or good transport through the system.

General Watershed Concerns

- Hydrophobic soils will likely increase mudflows and debris flows.

- An increase in peak flows and flooding is a primary concern. Scouring is anticipated in the upper reaches with deposition likely in the lower reaches.

- Soils appear to be highly erosive and the erosion potential appears to be very high in many areas.

- In many locations, the road system is not well drained and culverts are often either undersized or highly susceptible to plugging.

General Recommendations

- Upgrade the local early detection and warning system for rainfall, stream flow and debris flows to better protect downstream urban area. Providing timely notification to effected communities is often the best and most cost effective method of mitigation the damaging effects of flooding.

- Monitor the burned areas during and following rainfall events especially storms of one inch or more. Travel by ATV when conditions are too wet for travel by truck. High priority areas include:
  *The mouths of watersheds where they drain into residential areas
  *Flood control settling ponds
  *Specific areas of concern described in the individual watershed assessments below.

- Maintain unsurfaced roads using best management practices such as out-sloping, rolling dips and proper culvert sizing. Refer to the "Handbook for Forest and Ranch Roads" by William E. Weaver and Danny K. Higgins, June 1994, for specific road maintenance procedures. Contact the Mendocino County Resource Conservation District for copies of this handbook.

Watershed Assessments

Happy Canyon Watershed

Watershed description

The Happy Canyon watershed is located just east of the city of Moorpark near the eastern edge of Ventura County. It contains approximately 7,569 acres and flows generally from north to south directly into a golf course and residential area. As is common in this area, the topography tends to be gentle in the lower watershed with steep, incised drainages in the upper watershed. The vegetation was a combination of chaparral/brush, grass and scattered oaks. Some areas vegetated due to exposed rock. Aspects are largely north and south, but all aspects are found within the watershed. A large portion of this watershed is the Happy Camp Recreational Park. Recreational actives include horseback riding, mountain biking and hiking. Other land uses include livestock grazing, a sand quarry, agriculture, utility access (power and gas lines) and a

golf course. The watershed drains into flood control structures adjacent to residential areas.

Findings

Area of the watershed burned: An estimated 80 percent of the watershed was burned. The watershed is comprised of approximately 30 percent grasslands, 55 percent brush, five percent hardwoods, five unvegetated native soil/rock and five percent roads. The 20 percent of the watershed area that was not burned was attributed to either the quarry, access roads or unvegetated rock areas.

Burn Severity: The BARC burn severity map did not match up with the field estimates for burn severity. As described above, the field estimates were based on initial observations from the helicopter flight and subsequent ground checking. The BARC map appeared to significantly underestimate the amount of high severity and unburned areas. The percentages for the BARC analysis in the table below are base on ocular estimates.

Burn Severity	Field Estimates	BARC Analysis
Unburned to very low burn	20%	5%
Low	10%	30%
Moderate	40%	60%
High	30%	5%

In most areas the fire appeared to have spread rapidly. The areas of moderate and high burn intensities were usually in the chaparral/brush vegetation type. Grass areas associated with livestock grazing were generally either unburned or had low intensity burns. In many cases, some of the duff layer remained leaving a good source plant seed.

Soil Conditions: Eleven burned sites throughout the Happy Canyon watershed were tested using the protocol described above. Nine of the eleven tests found hydrophobic layers up to two inches in depth. Six of these sites found severe hydrophobic conditions from the surface to approximately one-half inch in depth. Most had no water absorption after 60 seconds. One site exhibited a hydrophobic layer at 2 inches in depth. Two sites had hydrophobic layers down to 4 inches. The two sites that exhibited no hydrophobic layer were tested to 4 inches in depth.

There appeared to be no fire suppression efforts made in this portion of the watershed other than possible water or retardant drops and thus no repairs were found to be necessary.

Roads: The roads in this watershed are primarily used for ranching and utility access (power and gas lines). Virtually all of the roads have been in place for many decades

and show few signs of modern drainage facilities i.e., water bars, rolling dips or outsloping. Most of the roads have had little use for some time. Road rilling, bank slumps, and washouts were observed. Utility roads have been reopened to repair fire damage. This has involved trimming trees and regrading of the road surface.

Potential Concerns:

- Recently opened roads by utility companies for wildfire damage repair potentially have watershed impacts due to road grading techniques. The north side of the watershed contains a considerable number of these access roads.

- Heavy concentrations of hardwoods at the lower portion of the watershed have the potential of introducing large woody debris into the watercourse channel. This in turn could potentially cause debris jams at the mouth of the watershed.

- The sandy quarry, located at the mouth of a western tributary at the base of the watershed, has the potential for introducing increased water flows (sediment pond draining) into an already compromised watershed. There is also a residence (9110 Happy Camp Road) located below this facility. Increased water flows adjacent to this structure could cause flooding.

- Recreational activities associated with the Happy Camp Canyon Regional Park could be impacted by major water flow events.

Recommendations

- Notify recreational users within the Happy Camp Canyon Regional Park of the potential for high flow events within the watershed.

- Advise the sand quarry operators of the potential hydrologic impacts caused by the fire within the watershed. Have the company operators schedule the timing for the draining of their sediment ponds to minimize impacts from high flows.

- Have the Happy Camp Canyon Regional Park employees monitor the stream channel for the introduction of large woody debris caused by tree mortality. If a significant amount of this material is observed have a crew either remove or chip the material.

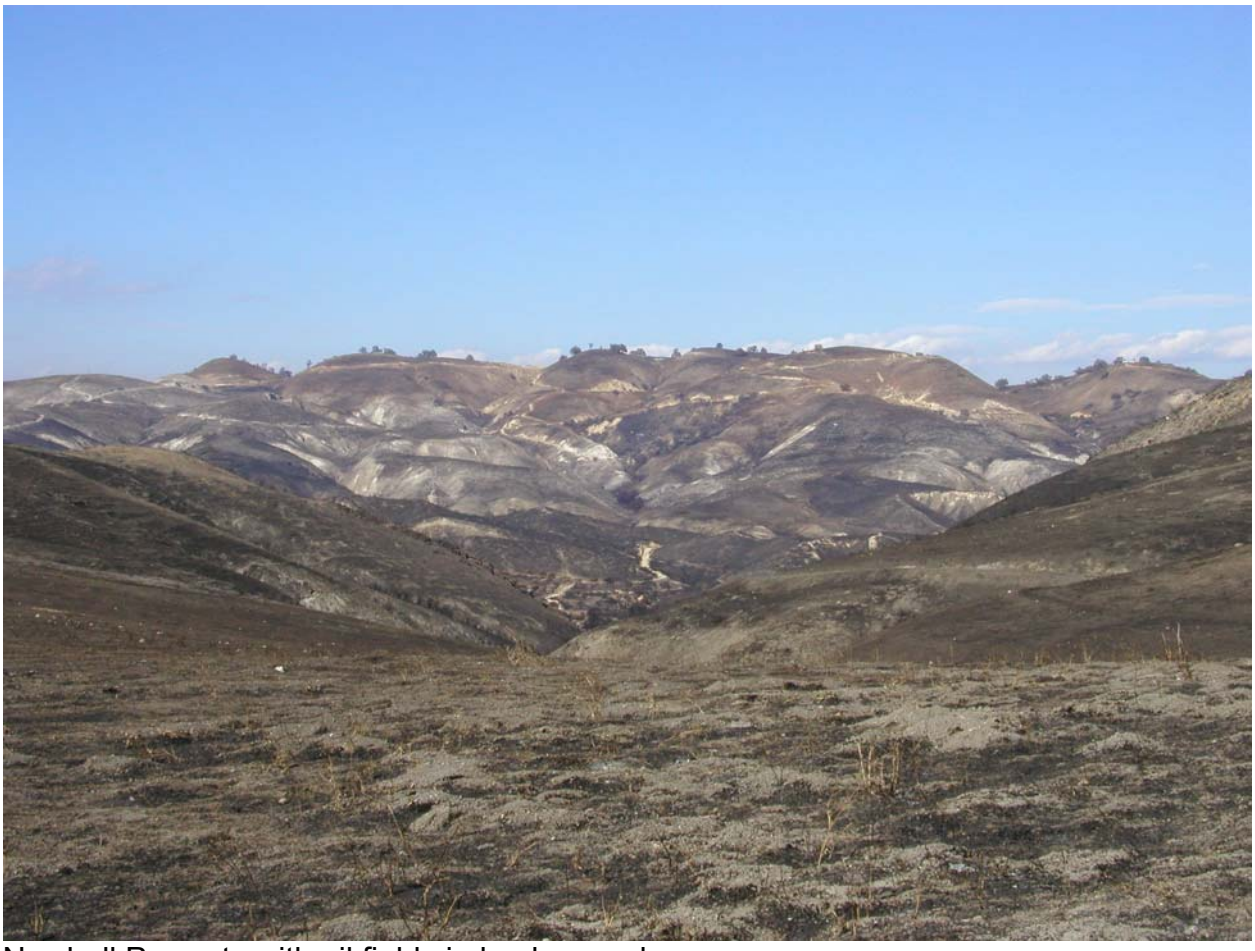
Tapo Canyon Watershed

Watershed description

The Tapo Canyon watershed is located just north of the city of Simi Valley, California near the eastern edge of Ventura County. It contains approximately 13,191 acres and flows generally from north to south directly into the residential area of Simi Valley. As is

common in this area, the topography tends to be gentle in the lower watershed with steep, incised drainages in the upper watershed. The vegetation is primary grassland with some chaparral/brush on the steep slopes and scattered oaks on the north-facing slopes of the lower watershed. Some areas have only very light vegetation or no vegetation.

The land use includes grazing, a wholesale plant nursery, the filming of motion pictures and extensive oil fields and mining. There are a few residences associated with the ranch properties and there is a golf course near the bottom of the watershed.



Newhall Property with oil fields in background.

Findings

Area of the watershed burned: An estimated 70 percent of the watershed was burned. Of this burned area, approximately 70 percent was grassland, 25 percent was chaparral/brush and 5 percent was tree covered. Most of the unburned area was either quarry, unvegetated, or road areas, however, small, scattered areas of unburned vegetation were common.

Burn Severity: The following estimates are based on initial observations from the helicopter flight and ground checking. These estimates appeared to be similar to the BARC analysis.

- Unburned to very low burn-30%
- Low-20%
- Moderate-45%
- High-5%

In most areas the fire appeared to have spread rapidly. In many cases, some of the duff layer remained unburned leaving a good source of plant seed.

Tapo Ranch Moderate Burn Severity.

Soil Conditions: Six burned sites throughout the western Tapo watershed were tested using the protocol described above. Five of the six sites were found to be severely hydrophobic from the surface to at least four inches in depth. Often there was no water absorption after four minutes. The sixth site was not hydrophobic. Approximately 12 sites were tested in the eastern part of the watershed and most were found to be

hydrophobic. Two unburned areas were evaluated and both were found to be severely hydrophobic. Thus there appears to be some natural hydrophobicity in the area. Sandy soils appeared to be more hydrophobic that clay soils, as supported by literature on soil hydrophobicity.

There appeared to be no fire suppression efforts made in this portion of the watershed other than possible water or retardant drops and thus no repairs were found to be necessary.

Roads: The roads in this watershed are primarily used to access oil fields, power lines and mining operations. There are also ranch roads on the mostly small, private ranches. The upper portions of the watershed are heavily roaded especially in the oil well areas. Virtually all of the roads have been in place for many decades and show few signs of drainage facilities i.e., waterbars, rolling dips or outsloping. These roads remain open and passable and are in relatively good condition with no major problems found.

Potential Concerns:

- The main watercourse from the quarry still contains stored sediment from the failure of the quarry settling pond dam during the 1994 earthquake.

White Oak- Humming Bird Watershed

Watershed Description:

The White Oak-Hummingbird watershed is located along the eastern boundary of Ventura County, above the city of Simi Valley. It is a small, 1,352 acre watershed. Approximately 80 percent of the watershed area flows into the Hummingbird basin. There are two main channels that flow out of this basin and into flood control structures within Simi Valley. One channel on the western edge of the basin has a debris basin; the other flows directly into concrete flood control structures. The other 20 percent of the watershed flows through the Corriganville Regional Park and then into flood control structures within Simi Valley. A large portion of the eastern half of the watershed is composed of exposed sandstone. The topography contains gentle to moderate slopes. Vegetation consists of only scattered grass and brush with a few oak and palm trees with riparian vegetation along the primary watercourse. The most notable constructed feature is the approximately 250-foot long concrete tunnel (12 feet wide by 14 feet high) at the base of the eastern basin that transports the watercourse flow under a very large fill supporting Highway 118 and into the Corriganville Regional Park. This area is primarily undeveloped with minor residential development and a large equestrian center.


White Oak Drainage- Moderate to Low Burn Severity.

Findings

Area of the watershed burned: An estimated 70 percent of the watershed burned. As noted above, the vegetation is relatively light and scattered.

Burn Severity: Based on observations made from the helicopter flight and subsequent ground checking, the following estimates of burn intensity were determined.

- Unburned to very low: 30%
- Low: 30%
- Moderate: 35%
- High: 5%

Approximately two-thirds of this watershed was analyzed using the BARC process. This analysis closely matched field observations

Soil Conditions: Soils are generally thin and rocky on the eastern half of the watershed and ranged from sandy to clay loam. Soils on the western half tended to be deeper and

were also sandy to clay loam. Soil testing for hydrophobic soils was completed at five sites throughout the watershed. All of the sites had a strong hydrophobic layer from the surface to about one-half inch. One sample had a hydrophobic layer down to 2 inches. It should be noted that even thought the soils showed a strong hydrophobic layer at the surface, the sandy loam soils tended to have a high moisture level after about one inch in depth. This can be attributed to prior the rain.

Roads: The western side of the watershed has a moderate number of roads. These roads seemed to be utilized for recreational purposes. Riling and gulling were observed on these roads. Due to the rocky nature of the soil, there did not seem to be an excessive erosion problem.

Potential Concerns:

- Runoff from this watershed is flashy (peaks and subsides quickly) because of the large amount of exposed rock.

- Plugging of the inlet of the large drainage tunnel under the highway could be a concern. However, the potential for debris flows is limited and there is not much woody material in the watershed that could become dislodged and wash down to block the tunnel.

- Recreational users within the Corriganville Regional Park potentially could be impacted by flash floods.

- Debris could potentially plug flood control structures if high storm flows removed vegetation within the stream channel. This would primarily be a concern for the main channel running out of the western edge of the watershed that does not have a debris basin.

Recommendations:

- Monitor burned vegetation within the main channel running out of the Hummingbird basin. The vegetation currently is stable and possible could assist in reducing water velocities through the channel. If there is a considerable amount of debris falling into the channel in the future, it should be removed or chipped on site.

- Monitor recreational users during high flow events.

- Monitor the inlet of the large tunnel under Highway 118 after storm events.

Devil Canyon Watershed

Watershed description

The watershed area drained by Devil Canyon is located just north of the city of Chatsworth in Los Angeles County, near the Ventura/Los Angeles County line. It contains approximately 8,000 acres and flows generally from north to south. Devils Canyon drains into Browns Canyon just north of the city of Chatsworth. The watercourse flows toward the Los Angeles River via man-made channels as it flows through the urban areas. The topography tends to be gentle in the lower watershed with steep, incised drainages in the upper watershed. The vegetation is primary grass and chaparral/brush on steep slopes. There are scattered oaks on the gentle slopes found on ridge tops and mid slope benches. Some areas contained sparse or no vegetation.

The land use includes grazing, an extensive network of oil fields and associated roads and recreation in the lower reaches consisting of horseback riding. There are a few residences associated with the ranch properties. There is also a series of communications towers on Oat Mountain.

Findings

Area of the watershed burned: An estimated 70 percent of the watershed was burned. Of this burned area, the majority consisted of chaparral/brush. The remainder was a mixture of oak woodland, native and non-native hardwoods, and grassland.

Burn Severity: The BARC map classification of burn severity was found to be a good representation of conditions on the ground. However, less than half of this watershed was included in the BARC analysis. It appeared that the fire spread rapidly in this area and likely did not burn intensely hot for a prolonged duration. The fire did produce white ash in many locations; however, the soil did not appear hydrophobic in every instance.

The areas assigned a high intensity rating in the field consisted of small mosaic patches less than five acres in size that were non-contiguous to other high intensity areas. These areas made up approximately less than five percent of the watershed. The following approximate burn severity was observed for the entire watershed:

- Unburned to very Low: 30%
- Low: 20%
- Moderate: 45%
- High: 5%

Soil Conditions: As in other watersheds, the primary focus of the soil evaluation was to determine the extent and severity of hydrophobic soils. The field indicators of burn severity were used to focus soil testing for hydrophobic soils. Twelve random sites throughout the watershed were tested using the protocol described above. Often there was little to no water absorption after four minutes. Soil textures varied depending upon location. Field observations included dense soils, clay soils, sandy soils, and soils with dampness three inches below the surface.

Fire suppression efforts consisting of handline construction and dozer line construction were observed. Much of the dozer lines were located on or adjacent to major ridges. It appeared that most of the dozer lines were waterbarred during fire suppression repair activities. Those that were not are located along the upper ridge west of the Devils Canyon Watershed near the Los Angeles/Ventura County line. However, there may be additional fire line elsewhere not observed during this evaluation.

Roads: The watershed contained several miles of paved and dirt roads that are open and passable. There are many short spur roads that access oil/gas field facilities. These roads appear to have been in place for many years. The roads are mostly insloped roads with few if any drainage structures. Multiple undersized culverts were observed.

Potential Concerns:

- Roads that cross watercourses low in the watershed are at risk of blowing out due to undersized culverts.

- Some road crossings do not have culverts and existing culverts are undersized and highly susceptible to plugging.

Recommendation:

- Continue fireline repairs as appropriate. This includes firelines located along the upper ridge west of the Devils Canyon Watershed near the Los Angeles/Ventura County line.

Chivo Canyon Watershed

Watershed description

The Chivo Canyon watershed is located just north of the city of Simi Valley between the Tapo Canyon and Las Llajas watersheds. It contains approximately 3,662 acres and flows generally from north to south directly into the residential area of Simi Valley. The topography tends to be steep with incised drainages and inner gorge features. The vegetation is primary grassland with some chaparral/brush on the steep slopes and scattered oaks in the drainages. Some areas have only very light vegetation or no vegetation.

The land use includes grazing and recreation.

Chivo Canyon Looking North to Upper End of Canyon

Findings

Area of the watershed burned: An estimated 85 percent of the watershed was burned. Of this burned area, approximately 45 percent was grassland, 50 percent was chaparral/brush and 5 percent was tree covered. Most of the unburned area was either unvegetated, grasslands or road areas.

Burn Severity: The fire burned with greater severity in this watershed. In most areas the fire appeared to have spread rapidly consuming most of the duff layer. The BARC map appeared to underestimate the amount of high severity and unburned areas. The percentages for the BARC analysis in the table below are base on ocular estimates.

Burn Severity	Field Estimates	BARC Analysis
Unburned to very low burn	15%	1%
Low	15%	29%
Moderate	50%	60%
High	205	10%

Soil Conditions: Two burned sites in the Chivo watershed were tested using the protocol described above. The two sites were found to be severely hydrophobic at the soil surface i.e., there was no water absorption after one minute. At one inch of depth, one site was a severely hydrophobic layer while the second site had low water repellency. At the two to four inch depth levels for both sites, the hydrophobic conditions were low with rapid absorption. The soils were clay, silty loam.

There appeared to be no fire suppression efforts made in this area and no constructed firelines were observed.

Roads: The roads in this watershed are primarily used for ranching and recreation. It appears that most of the roads have been in place for many years. Many of the roads have slides and washouts that block travel.

Potential Concerns:

- Hydrophobic soils appear to be common in the surface area only.
- Numerous landslides and rock falls were observed.
- The watershed drains directly into a golf course with no designated channel or sediment pond. This presents a high likelihood of flood damage to the golf course following a large storm event.

Specific Recommendations

- Develop a catchment basin prior to the golf course and/or create an adequate drainage channel through the golf course.

North Simi Dry Canyon Watershed

Watershed description
The Dry Canyon watershed is located just north of the city of Simi Valley and to the west of the lower portion of the Tapo Ranch watershed. It contains approximately 2,276 acres and flows generally from north to south directly into the residential area of Simi Valley. The topography tends to be gentle in the lower watershed with steep, incised drainages in the upper watershed. The vegetation is primary grassland with some chaparral/brush on the steep slopes. The land use includes a large, newly graded area for residential development, a golf course, and recreation. There were a few existing residences located near the mouth of the watershed.

Findings

Area of the watershed burned: An estimated 70 percent of the watershed was burned. Of this burned area, approximately 40 percent was grassland and 60 percent was

chaparral/brush. Most of the unburned area was either unvegetated, grasslands or road areas.

Burn Severity: The BARC map analysis compared favorable with the burn severity findings of the assessment team. The following estimates are based on initial observations from the helicopter flight and ground checking.

- Unburned to very low burn-35%
- Low-20%
- Moderate-40%
- High-5%

In most areas the fire appeared to have spread rapidly consuming most of the duff layer.

North-Simi-Dry Canyon Looking Southwest at Subdivision.

Soil Conditions: Three burned, scattered sites in the Dry Creek watershed were tested for hydrophobicity using the protocol described above. All three sites were found to be

severely hydrophobic. At the soil surface, water absorption occurred after 30 to 60 seconds. At one inch in depth water, absorption occurred after one minute or more. At two and four inches in depth, the hydrophobic conditions were low to moderate. The soils were clay silty loam.

There appeared to be no fire suppression efforts made in this watershed.

Roads: The roads in this watershed are primarily used for recreation, grazing and residential purposes. These roads remain open and passable and are in relatively good condition with no major problems.

Potential Concerns:

- One five-acre drainage at the base of the watershed flows directly through a residential area and hospital with no defined channel.

Specific Recommendations

- Develop a drainage structure near Sycamore Street for the sub-watershed described above.

Las Llajas Canyon Watershed

Watershed description

The Las Llajas Canyon is a long, narrow watershed containing approximately 4,327 acres. It flows generally from north to south into the residential area of Simi Valley and is bisected by the boundary line for Ventura and Los Angeles Counties. The topography tends to be steep with incised drainages and inner gorge features. The vegetation is primary grassland with some chaparral/brush on the steep slopes and scattered oaks in the drainages. Some areas have only very light vegetation or no vegetation.

The land use includes grazing and extensive oil fields. There were a few residences located near the bottom of the watershed prior the fire.

Findings

Area of the watershed burned: An estimated 95 percent of the watershed was burned. Of this burned area, approximately 40 percent was grassland, 50 percent was chaparral/brush and 10 percent was tree covered. Most of the unburned area was either unvegetated, grasslands or road areas.

Las Llajas looking Southwest, Mid Canyon.

Burn Severity: This watershed had one of the highest levels of burn severity observed with approximately forty percent of the burned area rated as high severity. In most areas, the fire appeared to have spread rapidly consuming most of the duff lay. The BARC map appeared to significantly underestimate the amount of high severity and over estimate the moderate severity areas. The percentages for the BARC analysis in the table below are base on ocular estimates.

Burn Severity	**Field Estimates**	**BARC Analysis**
Unburned to very low burn	5%	0%
Low	10%	15%
Moderate	45%	70%
High	40%	15%

Soil Conditions: Three burned sites throughout the Las Llajas watershed were tested using the hydrophobicity protocol described above. All three sites were found to be

severely hydrophobic at the soil surface with no water absorption after one minute. There was a low to moderate hydrophobic layer at one inch of depth with absorption taking from 5 to 40 seconds. At the two to four inch level, there was rapid absorption. The soils were clay silty loam.

Concentrations of stored sediment were observed within the drainage channels along with significant concentrations of large woody debris. The woody debris, if left in place, has the potential to obstruct the vertical drainpipe that is part of a down stream sediment catch basin. While there appeared to be no fire suppression efforts made, there was a dozer line constructed through the stream channel in the lower portion of the watershed. This should be fixed as soon as possible. This feature has the potential for diverting water onto the road causing further erosion and sediment transportation downstream.

Roads: The roads in this watershed are primarily used for residential access, recreation and grazing. Virtually all of the roads have been in place for many decades with only minor improvements such as cement rolling dips having been added in more recent years. These roads remain open and passable and are in relatively good condition with no major problems except for the dozer line described above.

Las Llajas Canyon Lower Third Looking East.

Concerns:

- Numerous landslides and rock falls were observed.

- There is the potential for transport of large woody debris in the main watercourse resulting in the blockage of a significant drainage structure.

- There was a significant degree of high intensity burning on approximately 100 contiguous acres within the Las Llajas Canyon. This condition was not captured on the BARC map.

Specific Recommendations

- Remove soil deposits from the dozer line constructed through the stream. Also, remove road fill that is encroaching in the stream channel. A backhoe or excavator will be needed.

- Selectively remove large woody debris out of the steam channel reduce the potential of debris plugging the drainage structures for the Las Llajas Canyon. The California Department of Fish and Game, the property owner and other responsible agencies should be contacted prior to starting the project. The debris removal should take place from the sediment basin to approximately 1.8 miles up the canyon. This section of channel is currently dry. At the 1.8 mile mark, the stream has standing water present. Due to habitat considerations, the rest of channel above to the top of the watershed should be avoided except for the removal of debris that could cause damage to the road system. Large woody debris that is currently in the stream channel should be chipped and spread over the ground in areas that are not accessible to peak flows. Pieces of debris that will likely fall into the channel this winter should also be removed. Other burnt vegetation that is standing and not a threat should be retained for bank stabilization. It should take one fire crew equipped with a chipper approximately 2 to 3 days to complete the required removal.

High Burn Severity

Santa Clara River Riparian Corridor

Watershed Description

A cursory survey was completed to assess the impacts from the Simi Fire on the Santa Clara River riparian corridor. This survey was conducted on 11/7/03 and 11/10/03. Due to time constraints and limited road access, visual estimates were made from a distance in some locations. The Santa Clara River is located in Ventura County and generally runs in an east to west direction towards the Pacific Ocean. Adjacent to the river is Highway 126, which parallels the northern bank of the river. The Simi Fire could potentially have impacts to sections of the river from Newhall on the east to Saticoy on the west. The river also travels adjacent to the communities of Piru, Fillmore and Santa Paula. Agriculture seems to be the major adjacent land use. Recreation and residential development are other minor uses. Riparian vegetation is a mixture of native and exotic species. The river basin ranges in width from approximately one-quarter mile to one-half mile. A highly erosive sandy soil is found throughout the river basin.

Burn Severity: Access was difficult throughout the Santa Clara River basin and an accurate estimate of the percent of burn severity was difficult to estimated. Over all, it appeared that a significant portion of the riparian area along approximately 15 miles of the Santa Clara River was burned with moderate severity. The following description starts just within Los Angeles County and proceeds downstream to the western edge of the fire in Ventura County.

The first location of fire extension into the riparian corridor occurred approximately 2.5 miles west of San Martinez Canyon Road off of Highway 126. The fire extended onto both sides of the riparian corridor for approximately 20 acres. Moderate burn severities were observed. Approximately 70 percent of vegetation in this area was consumed. Also in this location was an earthen dam constructed through the river. Culverts drain this dam.

The next fire extension into the riparian corridor occurred approximately two miles east of Santa Paula from South Mountain Road. This area was approximately 10 acres in size. 100 percent of the area was consumed. The burn only occurred on the south bank of the river. A buffer of approximately 100 feet of vegetation occurred between the river and the burned area. There was also a seasonal stream with a five-foot diameter culvert that fed into the burn area.

Then from one-quarter mile west of the last location, the fire again extended down into the riparian corridor on both sides of the Santa Clara River. This extension continues for approximately 8 miles to the western most edge of the fire. The river was inaccessible throughout this area and an accurate estimate of percent burned and burn severity were difficult to estimate. It appeared that all four-burn intensity classes occurred within the corridor, but moderate intensities seemed the most common.

Potential Concerns

- The impacts from increased peak flows associated with large storm events and the removal of vegetation that stabilizes the stream channel have the potential to change the stream morphology. The river basin is fairly large and can probably accommodate the changes in meanders through the basin. However, there is the possibility that stream morphological changes could potentially impact residential and agriculture uses.

- Citizens participating in recreational activities such as horseback riding, off road vehicle use and golf could potentially be impacted by major flood events.

- Due to the extent of the burned area and the removal of habitat within the riparian corridor, there could be potential be impacts to listed wildlife species.

Recommendations

- Stream morphology should be monitored throughout the winter to identify potential areas of impact to resources at risk. No immediate threats to resources at risk were identified. However, if resources at risk are identified in the future, professionals should be consulted in determining appropriate water diversion techniques and erosion control methods.

- Monitor recreational users prior to and during major rainfall events. Also, the Ventura County and Los Angeles County Fire Departments should review their swift water rescue plans to reflect the greater potential for flood related incidents.

- Consult the California Department of Fish and Game and other responsible agencies about the loss of riparian habitat and determine if any listed species will be impacted. If impacts are expected, a stream revegetation plan should be developed.

Pico Canyon and Towsley Canyon

Watershed Description

The watershed areas drained by both Pico and Towsley Canyons is located just west of Interstate Highway 5, Los Angeles County. These canyons contain approximately 9,000 acres and generally flow from west to east and northeast. Both Pico and Towsley Canyons eventually drain into the Santa Clara River, located just north of the community of Newhall. The topography is steep, deeply incised and dissected in the upper watershed and dramatically levels out on the valley bottom. The vegetation is primarily chaparral and grass. However, there is a component of scattered oaks on gentle slopes, ridge tops and canyon bottoms. Hardwoods such as sycamores and willows are found in the riparian areas. There are areas that contain sparse or no vegetation, especially on the steepest slopes. In general, the number of roads was limited due to the topography.

The land uses included gas and oil fields, recreation (mountain biking, horse back riding, hiking, etc) and residential develop. The community of Stevenson Ranch is located in the Pico Canyon area at the base of the watershed.


Towsley Canyon Raveling Soil.

Findings

Watershed area burned: Approximately 85 percent of the watershed was burned. The majority of this burned area was chaparral. The remainder was a mixture of grassland, oak woodland, native and non-native hardwoods and riparian areas.

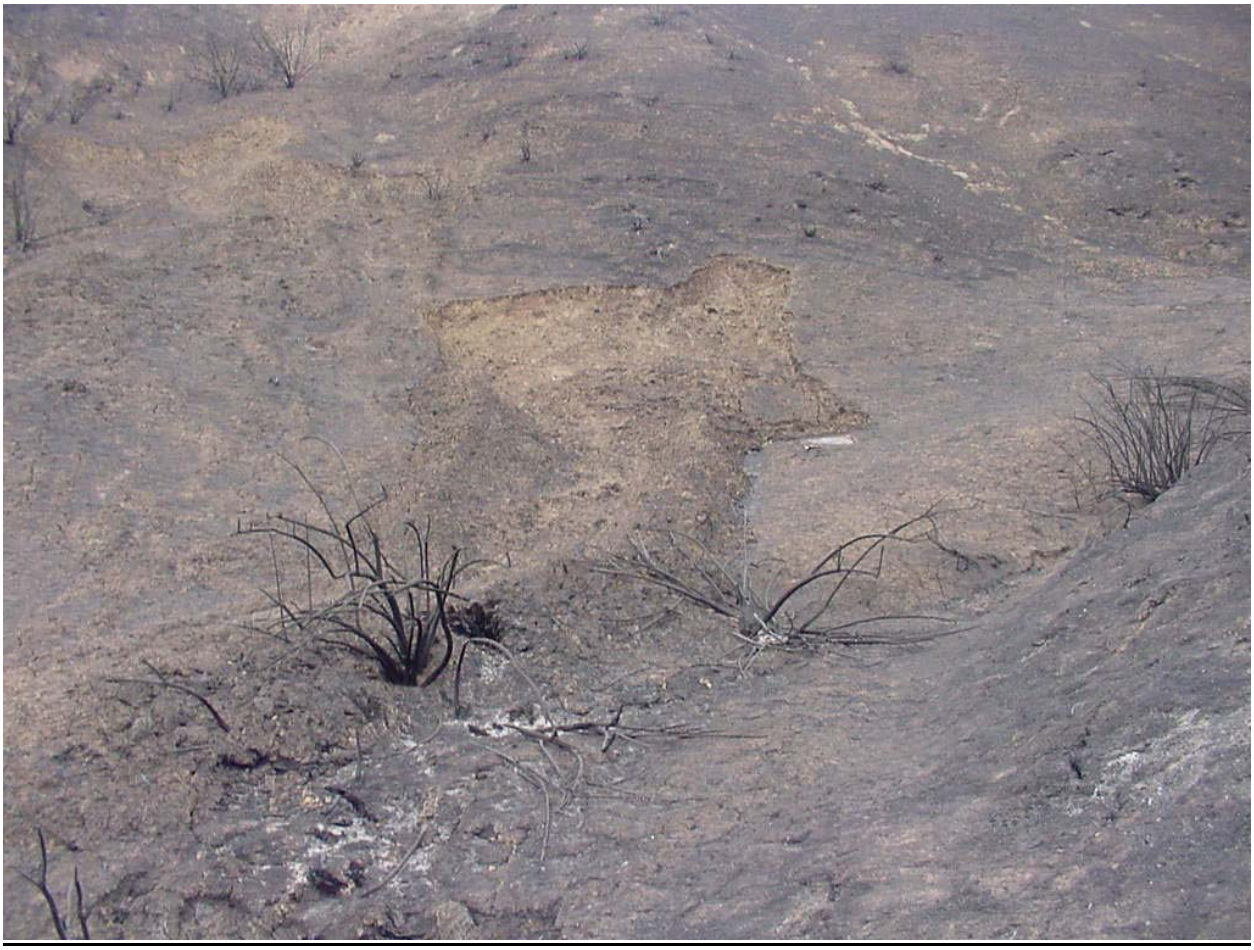
Burn Severity: In general, the burn severity on north-facing slopes was high due to denser vegetation prior to the fire. The dense vegetation was broken or patchy due to the steep, dissected topography, which would not support large contiguous areas of heavy vegetative cover. Burn severity was predominantly moderate throughout the watershed; however, it would have been higher intensity if the fuel loading was more contiguous. Burn severity was estimated as follows:

- Unburned to very low: 15%
- Low: 20%
- Moderate: 50%
- High: 15%

The BARC map depicting burn severity was not complete for the Pico and Towsley Canyon areas. Approximately one third of the area was covered by the aerial image. Those areas covered by the BARC map were a fairly good representation of conditions on the ground.

Soil Conditions: Twelve random sites throughout the watershed were tested for hydrophobic soils. All twelve sites were severely hydrophobic. Soil textures varied depending upon location. Field observations included clay and sandy soils. Soils were often damp up to three inches below the surface. Soil cracking was observed in the lower Pico Canyon. Dry raveling was observed on steep slopes. Small slope failures were observed in lower Pico Canyon, which had occurred following light precipitation on 11/8/03. Park Facilities Specialist Bob Reiss indicated that the Pico Canyon area usually experiences erosion problems annually.

Fire suppression efforts consisting of handline construction and dozer line construction were observed. Much of the dozer lines were located on or adjacent to major ridges.



Pico Canyon Slope Failure. Failure measures approximately 15' X 10'

Roads: The watersheds contained several miles of paved and dirt roads that are open and passable. There are many short spur roads that access oil/gas field facilities. These roads appear to have been in existence for many decades. The roads are mostly insloped roads with few if any drainage structures. Most culverts were undersized.

Potential Concerns:

- Pico Canyon contains the highest level of human life and property at risk of all the watersheds surveyed.

Recommendations:

- Consult with resource professionals including hydrologists and engineering geologists to assess the potential for flooding and mudflows in this area and recommend mitigations
- Continue to repair firelines.

Torrey Canyon Watershed

Watershed Description

Torrey Canyon is located within the Santa Clara River-Piru watershed in Ventura County. The watershed is south of Highway 126 on a north-facing slope that drains into the Santa Clara River just north of the community of Buckhorn. This watershed contains approximately 700 acres and generally flows south to north. The topography is steep in the upper watershed and contains less rugged to rolling topography closer to the valley floor. The vegetation in the area is primarily chaparral and grass. The land use is primarily oil and gas fields and power lines. There are many roads and spur roads that access these facilities.

Findings

Watershed area burned: Approximately 90 percent of the watershed was burned. Of this burned area, the majority consisted of chaparral. The remainder was a mixture of grassland or barren land.


Pico Canyon Looking Towards Stevenson Ranch

Burn Severity: As in the Pico watershed, the burn severity on the north-facing slopes was high due to denser vegetation prior to the fire. The dense vegetation was broken and patchy due to the steep topography, which would not support large contiguous areas of heavy vegetative cover. Burn severity was predominantly moderate throughout the watershed. However, it would have been higher severity if the fuel loading was more contiguous.

Unburned: 10%
Low: 10%
Moderate: 60%
High: 20%

The BARC map depicting burn severity was a fair representation of field conditions although it tended to underestimate the burn severity.

Soil Conditions: No soil samples were taken. Dry raveling was observed on steep slopes. No fire suppression efforts such as handline and dozer line construction were observed.

Roads: The watershed contained several miles of paved and dirt roads that are open and passable. There are many short spur roads that access oil/gas field facilities. These roads appear to have been in existence for many decades. The roads are mostly insloped roads with few if any drainage structures. Most culverts undersized.

Potential Concerns:

- Petroleum storage and transportation facilities within the canyon suffered damage from the fire. There was a strong odor of petroleum in the area. The fire damage to the facilities may have caused a leak. This potential leak may threaten downstream water quality including the fish bearing Santa Clara River.

Recommendations:

- A qualified person should inspect the oil facilities for damage and leaks.

Torrey Canyon

Verdale Incident

The Verdale Incident is located north of the Simi Incident on the north side of Highway 126 and east of the town of Piru, California. It contains approximately 8,488 acres. This fire is in both Los Angeles and Ventura counties on federal responsibility area. The vegetation is primarily grassland with some chaparral/brush on the steep southern slopes and chaparral on the steep northern slopes. The northern slopes tended to have the highest severity burning while the southern slopes burned lighter in severity with many areas of unburned fuel. The field evaluation concentrated on Holser Canyon and the Del Valle area of Chiquito Canyon.

Only a cursory survey was made of the Holser Canyon due to lack of significant resources at risk. Only the north facing slopes appeared to have burned with some of these areas having burned with moderate to high burn severity. Some low severity burn areas were observed. Also, the San Martinez Grand Canyon was observed from the Del Valle area. Here, the north facing slopes appeared to have burned hotter than the south facing ones. Furthermore, the south facing slopes off Highway 126 appeared to have burned with low to moderate severity.

Del Valle Canyon Watershed

Watershed description

The Del Valle Canyon watershed is located just west of Chiquito Canyon near the town of Del Valle in Los Angeles County. It contains approximately 50 acres and flows generally from west to east directly into a county park. The topography tends to be steep and rises up quickly from the valley. Recreation seems to be the only land use.

Findings

Area of the watershed burned: An estimated 50 percent of the watershed was burned. Of this burned area, approximately 25 percent was grassland, 70 percent was chaparral/brush and 5 percent was tree covered. Most of the unburned area was grassland or tree areas.

Burn Severity: The following estimates are based on initial observations from the helicopter flight and ground checking. The BARC analysis did not include this area.

- Unburned to very low burn-60%
- Low-25%
- Moderate-15%
- High-0%

In many cases, patches of unburned fuels contained duff layers containing a good source of plant seed. The fire appeared to have been a backfiring operation. Burn severities tended to be low to moderate with spotty fuel consumption.

Soil Conditions: Only one site within this watershed was tested for hydrophobicity. This site was found to be severely hydrophobic from the surface to at least 1 inch in depth with no water absorption after one minute. The two and four inch layers were moderate and low, respectively, in hydrophobicity. The soils were a course, sandy-silty loam.

Roads: The road in this watershed is primarily used for fire control and recreation. The road has been currently maintained, yet water is allowed to flow over some sections of road during the winter months. This road remains open and passable and is in relatively good condition with no major problems found.

Potential Concerns:

- Currently, the drainage pattern flows directly into the park facilities and parking lot. Temporary water diversion devises are in place, but are insufficient.

Recommendations:

- Develop permanent drainage structures to address the concern described above.